Barr
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133511

November 22, 1991

Ms. Cindy Nolan
On-Scene Coordinator
U.S. EPA (5HS-12)
230 South Dearborn Street
Chicago, IL 60604

Mr. Paul Steadman
On-Scene Coordinator
U.S. EPA
230 South Dearborn Street
Chicago, IL 60604

Mr. Sean Mulrony
Assistant Regional Counsel
U.S. EPA (5CS-TUB-3)
230 South Dearborn Street
Chicago, IL 60604

Re: Waukegan Tar Pit Site

Dear Ms. Nolan, Mr. Mulrony, and Mr. Steadman:

Enclosed is the QA/QC Plan for the Supplemental Study Work Plan submitted pursuant to the September 4, 1991 unilateral Administrative Order, Docket No. V-W-'91-C-115, in the matter of Waukegan Tar Pit Site.

Materials transmitted to you yesterday were the Supplemental Extent of Contamination Study Work Plan, which included the Technical Specification for Soil Borings and Monitoring Wells as Appendix A. Also transmitted yesterday was the Site Safety Plan.

Please contact me with any questions or comments.

Sincerely,

Lawrence D. Dalen

JSL/lah
Enclosures
c: Russ Selman
Pat Doyle
Murray Conzelman
Melissa Wynne
Alice Saylor
Andrew Armstrong
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Lawrence D. Dalen

Your Phone Number (Very Important) (612) 832-2600

Company: Barr Engineering Co.

Department/Floor No: Suite 300

Street Address: 8300 Norman Center Drive

City: Minneapolis State: MN ZIP Required: 55437

2 To (Recipient's Name) Please Print

Ms. Cindy Nolan

Recipient's Phone Number (Very Important) ( )

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Department/Floor No:

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Quality Assurance/Quality Control Plan

Extent of Contamination Study
Waukegan Tar Pit Site

Prepared for North Shore Gas Company
Elgin, Joliet and Eastern Railway Company
North Shore Sanitary District

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QUALITY CONTROL/QUALITY ASSURANCE PLAN

WAUKEGAN TAR PIT SITE

EXTENT OF CONTAMINATION STUDY

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SECTION 3.0
PROJECT DESCRIPTION

3.1 INTRODUCTION

This QAPP presents the organization, objectives, functional activities and specific QA and quality control (QC) activities associated with sampling and analysis activities as part of the work plan to implement the extent of contamination study at the Waukegan Tar Pit site.

This section describes the location, the existing conditions at the tar pit, history, the topography, and the findings of previous investigations at the tar pit. Based on that understanding of the site, target compounds are identified, project objectives are defined, and data quality objectives are developed.

3.2 SITE DESCRIPTION

The Waukegan Tar Pit Site (WTPS) is located in the east-central part of Waukegan, Illinois about 1/2 mile northeast of the downtown business district and 1/2 mile west of Lake Michigan. Figure 1 shows the WTPS location. Figure 2 shows the immediate vicinity of the WTPS, which is bounded on the north by Dahringer Road and beyond that by vacant property. It is bounded on the west by Pershing Road, and a rail yard of the Chicago Northwestern Railroad. A bluff rises beyond the rail yard and above the bluff line, about 2,000 feet from the WTPS is Sheridan Road and residential development. The WTPS is bounded on the east by the EJ&E railway line and the facilities of the NSSD. The WTPS is bounded on the south by vacant property owned by the City of Waukegan and EJ&E. The WTPS is bounded on all sides by a chainlink fence.

3.3 TAR PIT DESCRIPTION

The tar pit hereafter referred to is located in the northeast corner of the WTPS. The tar pit is covered by 4 to 6 inches of water and occupies an area estimated to be 15,800 square feet, or 0.36 acres, is the subject of the AOC.

The topography of the ground surrounding the tar pit is nearly level. According to the U.S. EPA, the soils immediately south of the tar pit are softer than elsewhere in the vicinity of the tar pit. Surface waters on the site are limited to water collecting on the tar pit.

3.4 TAR PIT HISTORY

The tar pit hereafter referred to is located in the northeast corner of the WTPS. The tar pit which is covered by 4 to 6 inches of water and occupies an area estimated to be 15,800 square feet, or 0.36 acres, is the subject of the AOC. The topography of the ground surrounding the tar pit is nearly level. Surface waters are limited to water collecting on the tar pit.

Sampling has yielded the following results:

- Water at the tar pit - benzene at 69 ppb, toluene at 59 ppb, and xylene at 18 ppb.

- Tar pit sediment - ethyl benzene at 230 ppm, xylene at 2,000 ppm, o-dichlorobenzene at 6,700 ppm, nitrobenzene at 620 ppm, benzene at 530 ppm, and toluene at 810 ppm.

- Tar 50 feet north of the pit - ethyl benzene at 710 ppm, xylene at 660 ppm, cyclohexane at 80 ppm, o-dichlorobenzene at 210 ppm, benzene at 180 ppm, and toluene at 380 ppm.

3.5 TARGET COMPOUNDS

Compounds of concern at the Tar Pit are listed in Table 1. All samples will be analyzed for the compounds in Table 1. The compounds were selected based on:

- previously detected concentrations
- suspect contaminants from manufactured gas/coke plant operations

The quantitation limits for the target compounds are also provided in Table 1.

3.6 PROJECT OBJECTIVES

The objectives of this study as defined by the AOC (p. 5) are:

1. To conduct an extent of contamination study of the tar pit including sampling and analysis to define the vertical and lateral extent of hazardous substances in the tar pit.

2. To submit a report which shall summarize the study and identify the removal methods for the tar pit which must be protective of human health and the environment.

The study will begin within seven calendar days after written approval of this work plan by the U.S. EPA. The extent of contamination study will be

completed within 30 calendar days. The study report will be submitted within 14 days of completion of the extent of contamination study.

3.6.1 Data Quality Objectives

Data quality objectives (DQO) define and specify the quality of data required for the intended use of the data. The degree of certainty of a data set with respect to precision, accuracy, representativeness, completeness, and comparability is an indication of the data quality.

There are five defined levels of analytical data outlined below:

1. Level I -- Field Screening. The objective of this level of analysis is to generate data to be used in refining sampling plans; determining gross extent of contamination at the site and to select "worse case," representative," and "clean" samples for laboratory analyses. This type of data also provides real time monitoring for health and safety.

2. Level II -- Field Analysis. The objective of this level of analysis is to provide real-time data for on-going field activities or when initial data will provide the basis for the selection of additional laboratory analyses. Analyses include the use of an on-site close support laboratory.

3. Level III -- Laboratory Analysis. This level of support is designed to provide laboratory analyses using standard EPA-approved procedures other than the current CLP Routine Analytical Services (RAS). This level provides data for site characterization, environmental monitoring, confirmation of field data, and to support engineering studies.

4. Level IV -- Contract Laboratory Program (CLP) Routine Analytical Services (RAS). This level provides for the highest level of data quality with full CLP analytical, quality control, and validation procedures in accordance with EPA protocols. The data is used for risk assessment, confirmation of lower level data, and to obtain highly documented data.

5. Level V -- Nonstandard Methods. The objective of this level is to provide data not obtained through standard avenues of analytical support. This usually involves modification of existing methods or method development. The level of quality control is usually similar to Level IV data.

The data quality objectives for the data collected during SI activities are specified below:

Sample	Laboratory Parameters	Level of Data Quality
Tar Pit Composite	Benzene, Ethylbenzene, Toluene, Xylene	III
	Polynuclear Aromatic Hydrocarbons (PAHs)	III

3.7 SAMPLE NETWORK AND RATIONALE

The depth and thickness of the tar in the tar pit will be investigated by penetration techniques. A metal probe will be pushed into the tar as far as possible. Since the tar is much less resistant to penetration than the underlying soil, the depth of probe refusal should correspond to the depth of tar. The depth of probe refusal and the depth of overlying water, if any,

will be recorded in the field. A tar sample will be collected at each of the three locations in Figure 3. The three samples will be homogeneously composited to make up one sample for analysis.

SECTION 4.0

PROJECT ORGANIZATION

4.1 BARR ENGINEERING CO. PERSONNEL AND RESPONSIBILITIES

Barr Engineering Co. (Barr) is responsible for study design, field investigation activities, coordination of subcontractors (drillers, excavators, analytical laboratories), tar sampling, data review, and reporting.

The project team consists of a principal, project manager, hydrogeologist, project geologists, project safety officer, quality assurance manager, and support staff.

The Barr principal, Dean Malotky, is responsible for overall management of the project and assurance that the goals of timeliness, quality, and cost-effectiveness are met.

The Barr project manager, Lawrence Dalen, is responsible for: preparing work plans and scoping documents; coordination, scheduling, and oversight of project activities with project team members; communicating with the client, subcontractors, and the MPCA project manager, and the analytical laboratories; and reporting of the data and findings generated by the study.

The project hydrogeologist, Ray Wuolo, is responsible for coordinating the tar investigation, collection of tar samples, and preparation of sample logs.

The project safety officer, Mary Diamond, is responsible for developing the RFI site safety plan, coordinating the safety training and medical monitoring of investigation personnel, and maintaining safety records.

The Barr quality assurance officer, Mary Mackey, is responsible for assisting the project manager in specifying project QA/QC procedures, specifying field sampling and sample analysis methods to be used in the study, auditing the sampling and analytical activities to ensure that the proper techniques and appropriate quality control procedures are followed, reviewing analytical results and quality control data, recommending corrective actions when necessary, and preparing a quality control report.

Review of analytical results and quality control data by the quality assurance officer will include:

- determination of potential outliers
- determination of potential false positive values based on review of field blanks and laboratory blanks
- assessment of the precision and accuracy of the analytical results of environmental samples
- assessment of the precision of the analytical results of interlaboratory split samples and masked duplicate samples
- examination of raw data on analyses that are considered suspect or anomalies.

4.2 LABORATORY RESPONSIBILITY AND ORGANIZATION

CH_2M Hill Environmental Laboratory (CH_2M Hill) will be responsible for the analysis of tar samples. Herb Kelly, Organic Division Manager, will be responsible for overall project management, data validation and quality assurance activities at the laboratory. Additional information on the organizational structure of the laboratory is provided in Figure 4.

SECTION 5.0

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS AND COMPARABILITY

The overall QA objectives are to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide the level of data required for determining the concentration of the analytical parameters in soil and groundwater. Specific procedures to be used for sampling, chain-of-custody, calibration of field instruments, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective actions are described in other sections of this QAPP. This section will address the objectives of precision, accuracy, completeness, representativeness and comparability.

- Precision measures the reproducibility of measurements under a given set of conditions. It is a measure of the variability of a group of measurements compared to an average value.

- Accuracy measures the bias in a measurement system. Possible sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques.

- Completeness is defined as the percentage of measurements made that are judged to be valid measurements.

- Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or environmental conditions.

- Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another.

To assess these five parameters, both sampling and analysis options are employed.

5.1 SAMPLING QUALITY ASSURANCE

5.1.1 Field Sampling

Field duplicate (replicate) samples will be collected in the field and submitted to the laboratory to assess the sampling precision. Field duplicate (replicate) samples will be used to assess the combined effects of sample collection, handling, and analysis on data precision. Sampling accuracy is assessed through evaluation of results of both field and trip blanks.

Field duplicate (replicate) samples will be collected at the minimum frequency of ten percent or one per day per group of analytical parameters.

The goal of completeness is to ensure that a sufficient amount of valid data are generated. The number of samples obtained should provide sufficient valid data.

The objective of representativeness is to assess whether the information obtained during the investigation accurately represents the actual site conditions. The sampling network was designed to provide data representative of site conditions. All field sampling activities will be performed following standard sampling techniques and are outlined in the field sampling

plan. Factors which will be considered during the evaluation of representativeness include:

- environmental conditions during sampling
- sampling and analytical methodologies
- sampling network - location and number of samples
- analytical parameters.

The use of the standard sampling procedures and recognized field techniques for sampling should make the resulting data comparable to other measurements on similar samples under similar sampling conditions.

5.2 LABORATORY QUALITY ASSURANCE

The QA goals for the analytical services are established under the laboratory QA Manual. Precision and accuracy requirements for analyses are specified in the laboratory/analytical procedures. Precision and accuracy data which meet the precision and accuracy requirements of the laboratory QA program will be sufficient to meet the objectives of this project. Data that do not meet precision and accuracy requirements will be assessed on a case by case basis to determine if they are usable to support project objectives.

Data completeness can be quantified during data assessment. The goal of any monitoring program is to achieve 100 percent data completeness. It is highly unlikely that this goal will be achieved for all sampling events during this project. The goal for completeness on this project is 95 percent. All data that meet QA/QC acceptance criteria will be used in the

decisionmaking process, even if the data set as a whole or for any analytical fraction does not meet the completeness goal.

Representativeness assesses the degree to which the data represent actual site conditions. The use of standard sampling techniques and the design of the sampling network provide data representative of site conditions. The use of standard procedures to analyze representative samples provides comparable data.

SECTION 6.0

SAMPLING PROCEDURES

6.1 INTRODUCTION

The general objective of sampling is collection of a sample representative of conditions at the monitoring point. The project-specific sampling objectives, as outlined in the work plan, will be reiterated by the project manager or on-site team leader before each day's sampling begins. Prior to visiting the site, all team members will review the sampling plan, the site safety plan, and the QA/QC documents.

All sampling and probing equipment will be carefully cleaned before use. Trowels or other apparatus used to sample tar will be cleaned with tsp solution and rinsed with tap water prior to sampling. All probes or other apparatus used to evaluate the depth and extent of tar will also be cleaned with tsp solution and rinsed with tap water prior to sampling.

Before sampling commences, a visual evaluation of the site will be conducted. The visual evaluation will include observation of sampling points, routes of access, key landmarks, and assessment of potential hazards. During sample collection, the work plan and the QA/QC document will be followed in detail and the sampling procedures and pertinent observations will be documented.

If potentially hazardous samples are collected, samples and sampling gear will be decontaminated as specified in the safety plan prior to leaving the facility.

6.2 SAMPLING AND INVESTIGATION PROCEDURES

6.2.1 Tar Depth and Extent Investigation

The depth and thickness of the tar in the pit will be investigated by penetration techniques. The following procedures will be used:

1. A three-person crew will be used to collect data on tar depth. Two of the site crew will perform the penetration tests and a third site crew member will operate survey equipment adjacent to the tar pit. Two of the crew members will drag equipment to the predesignated sampling locations over ice on the tar pit. Life jackets will be worn at all times, whether the ice is supportable or not. In addition, a safety rope will be tethered to the plywood panel and extend to the third crew member at the edge of the tar pit.

2. A metal probe approximately 6-feet long and 1/2-inch in diameter will be pushed by hand into the tar as far as possible. Since the tar is much less resistant to penetration than the underlying soil, the depth of probe refusal should correspond to the depth of tar. If there is ice on the pond, an access hole will be chopped or augured into the ice. The depth of probe refusal and the depth of overlying water, if any, will be recorded in the field. Surveying instruments located adjacent to the pit will be used to survey elevation, location, and sample points. Survey data will be keyed into a known benchmark.

   Three vane shear tests may be performed at selected locations. To verify that the material underneath the tar is substantially more resistant to penetration than the tar material, The vane shear apparatus consists of a narrow wooden paddle attached to a shaft. The

vane is inserted into the tar and a torque wrench is used to record the amount of force necessary to twist the paddle in the tar. The paddle is pushed at successively deeper depths and the shear test is repeated until further penetration is not possible. The relative resistance to shear is noted as a function of depth and the results is compared to the rod penetration tests performed at adjacent locations.

6.2.2 Collection of Tar Samples

A Tar sample will be collected at each of approximately three locations. Samples will be collected with a small trowel and each sample will be placed in a new 1-gallon metal paint cans and sealed. Sampling procedures will be as follows:

1. An access hole through the tar pit ice will be chopped or augured through the ice by the two-man sampling crew.

2. One crew member will use a trowel to reach below the ice and retrieve a tar sampling to a depth of approximately 6 inches. Tar samples will be placed in new 1-gallon paint cans. Approximately 4 quarts of tar will be obtained from each sampling location. The 1-gallon paint can will be sealed after each sample is collected.

3. A third crew member will operate survey equipment adjacent to the tar pit to collect data on the location of each sampling point.

4. The composite sample will be prepared by mixing equal portions of sample from each of the sample locations in a 1-gallon paint can.

6.3 SAMPLE IDENTIFICATION AND NUMBERING

Samples will be identified with a number unique to the location of sample. QC samples (field duplicates) will be identified with the prefix m for masked duplicate sample followed by a sequential number (i.e., m-1, m-2 ...)

6.4 SAMPLE TRANSPORTATION

Samples will be transported to the laboratory by shipping via a next-day delivery service. Shipping receipts will be retained for all samples.

6.5 DISPOSITION OF TAR SAMPLES AND SAMPLING MATERIALS

Tar samples collected at the tar pit for analyses will be consumed by the laboratory. Portions of the vane shear test apparatus which are submerged in the tar will be largely made of wood and will be stored in a designated area within the fenced perimeter of the site until further disposition is possible. Nonexpendable equipment will be scraped free of tar using wooden spatulas and washed with a solution of tsp and tap water. Wash water will be returned to the pond. Other expendable tools and protective clothing, if any, will be bagged and brought back to Barr Engineering Co.

SECTION 7.0

CHAIN OF CUSTODY

7.1 FIELD CHAIN OF CUSTODY

7.1.1 Sample Identification

A label will be attached to each sample container before the sample is collected. The label will contain the sampling station identification, date collected, project identification number, and sampler's initials. An example of the sample label is provided in Figure 5.

7.1.2 Field Logs

A bound field log book will be maintained throughout the monitoring program. Field measurements and other pertinent information about field activities will be recorded.

7.1.3 Chain of Custody

The field sampler will be responsible for custody of samples until they are properly dispatched to the laboratory or turned over to an assigned custodian. The field sampler will ensure that possession or sight of sample containers is maintained at all times or that the containers are stored in a securely locked area. A chain of custody form is shown in Figure 6.

The chain of custody procedures will apply to all samples collected. All entries will be completed in indelible ink. The original chain of custody record and one copy will be sealed in a waterproof container and shipped inside the sealed transportation case. A second copy of the record will be

retained by the sampling team, and the third copy will be retained by the Barr Engineering Co. quality assurance manager.

The addresses of the consignee and consignor will be printed on the outside of the transfer container or attached firmly thereon by cards and labels. As necessary, warning and descriptive labels will be attached to the transfer container. A chain of custody record will be included with each transfer container to identify the samples in the transfer container and to summarize the analyses to be carried out on each sample.

7.2 LABORATORY CHAIN OF CUSTODY

Once samples are received in the laboratory, they are placed in a secure storage area to which only laboratory personnel have access. The general criterion used to determine if a sample is in custody at CH_2M Hill's Laboratory is if:

- It is actually in an analyst's possession; or
- It is in the analyst's view after being in his or her physical possession; or
- It is in a secure area.

To satisfy these custody provisions, the laboratory the following procedures:

- Samples are stored in a secure area.

- Access to the laboratory is through a monitored reception area. Other access doors to the laboratory are kept locked.

- Visitors must sign in at the reception area and are escorted while in the laboratory.

- Samples remain in the secure storage area until they are removed for sample preparation or analysis.

- Refrigerators, freezers, and other sample storage areas are locked during nonwork hours.

- Only the sample coordinators and supervisors have keys to the sample storage area(s).

- After a sample has been removed from storage by the analyst, the analyst is responsible for the custody of the sample. Each analyst must return the samples to the storage area before the end of the working day.

- For clients requiring internal chain-of-custody, a sample control record is completed and placed in the case file. Access is through the sample custodian, who maintains this record until the analyses are completed and the data is released.

7.3 CUSTODY OF EVIDENCE FILE

Until completion of the project, all correspondence, laboratory reports, and data will be maintained in Barr Engineering project files. All original laboratory reports and field data are maintained in their original format and

stored separately from working copies of these reports. The Barr project manager and Barr Information Services Specialists will maintain the project file. Following completion of the project, the evidence file will be stored in the Barr Engineering Co. project file storage area or transferred to a secure document storage facility.

SECTION 8.0

CALIBRATION PROCEDURES AND FREQUENCY

8.1 LABORATORY CALIBRATION PROCEDURES

Every instrument used to analyze samples must pass the calibration criteria established in the appropriate SOP. Initial calibration criteria for instrument linearity, sensitivity, resolution, and deactivation must be met before samples can be analyzed. Sustained performance is monitored periodically during sample analyses by the use of continuing calibration check standards.

SECTION 9.0

ANALYTICAL PROCEDURES

Samples collected will be analyzed following the EPA procedures outlined in Test Methods for Evaluating Solid Waste, SW 846, Method 8020 for benzene, toluene, ethylbenzene and xylenes and Method 8100 for polynuclear aromatic hydrocarbons (PAHs).

SECTION 10.0

INTERNAL QUALITY CONTROL CHECKS

10.1 LABORATORY ANALYSES

Internal quality control checks are described in the specific analytical procedure.

SECTION 11

DATA REDUCTION, VALIDATION, AND REPORTING

11.1 DATA REDUCTION

11.1.1 Laboratory Analyses

Analysts are responsible for the reduction of raw data when such steps are required to produce the correct data format for reporting. Data reduction may be done manually or through one of a number of computer programs used in the laboratory.

11.1.2 Field Measurements

Raw data from field measurements and sample collection will be recorded on the field data sheets. All specific conductivity data will be corrected to 25°C. The data will be transferred from field data sheets to a computer database and output in a spreadsheet format.

11.2 DATA VALIDATION

11.2.1 Laboratory Data Review and Validation

When data has been acquired for a sample, the initial review is done by the analyst. This review covers sample identification, check of analyses requested against the LIMS record, review of procedures and notebook data, check of calculations done, QC data, and checking for transcription errors. Following this review, the sample data with supporting information as required may be reviewed by a peer, but is always reviewed by the analyst's supervisor.

The supervisory review includes checking for correct analyses performed, correct sample identification, proper choice of method, correct calculations, investigation of all related quality control data, and correct transcription of all data.

The ultimate responsibility for the analytical results lies with the division manager who makes the final review. All out-of-control conditions noted are reviewed by the Laboratory Quality Assurance Coordinator (LQAC) and the division manager. Decisions concerning these out-of-control conditions are made jointly by the division manager and the LQAC.

After data has been entered into the reporting system, a draft report is reviewed by the supervisor or division manager. This review includes a check of holding times met, correct analysis and report dates, and correct reporting units, as well as a review of results, quality control data, and transcription. At any point in the review process, if an error is found, the analyst has the responsibility for investigating the problem and initiating the correction. During the review process, points which should be brought to the client's attention, such as missed holding times or matrix effects noted in samples, are noted for inclusion in the case narrative or cover letter.

The LQAC routinely checks approximately 90 percent of completed data packages before submittal to the client.

Data validation is part of the review process whereby data are inspected and either accepted or rejected based on a set of criteria. Before analytical results are reported to the client, this review and approval process must be completed.

The analyst has the initial responsibility for proper instrument conditions and calibration, for the data meeting all acceptance criteria, and for all calculations being accurate. After proper instrument conditions and calibration are verified, data generated is validated on the basis of accuracy, precision, and how the data compare with the established limits of detection. Attention is paid to possible outliers. Statistical tests are used to ensure that if data are rejected, it is done with a high level of confidence.

11.2.2 Barr Engineering Co. Data Validation

Data will be evaluated by the Barr Engineering QA officer to determine if it meets project requirements. Data validation procedures will be consistent with the EPA documents for Laboratory Data Validation - Functional Guidelines for Evaluating Organic Analyses and Inorganic Analyses. The specific requirements which may be checked during data validation are listed below:

1. Holding Times
2. GC/MS Tuning
3. Method Blanks
4. Calibration
5. Surrogate Recovery
6. Matrix Spike/Matrix Spike Duplicate
7. Field Duplicates
8. Field Blanks
9. Overall Data Assessment

Upon completing the validation procedure for all data, a quality control review report will be compiled and submitted to the client and regulatory agencies overseeing the project.

11.3 DATA REPORTING

11.3.1 Laboratory Analysis

There are three basic levels of quality control to clients. The levels differ in the number and frequency of quality control samples run and also in whether or not samples such as spikes and duplicates are client-specific.

Level 1 offers a basic sample data package with no client-specific QC samples. Level 2 includes client-specific quality control samples and some additional information. Level 3 corresponds to a full CLP package.

Data generated will be reported by the laboratory using a Level 1 reporting format. The laboratory data package will include at a minimum:

1. Date of Extraction/Analysis
2. Method Blank Data
3. Surrogate Recovery Data

Data will be entered into a computer database and output in spreadsheet format to be used in reports.

SECTION 12

PERFORMANCE AND SYSTEM AUDITS

12.1 EXTERNAL AUDITS

12.1.1 Laboratory Audits

The laboratory is presently certified in many states and under several certification programs.

The laboratory submits to external on-site systems audits conducted by the states in which it is certified or seeking certification and by other certifying agencies.

12.2 INTERNAL AUDITS

12.2.1 Laboratory Audits

Internal audits of the laboratory are conducted in two phases.

The first phase is conducted by the District Quality Assurance Manager at least once a year. This is usually a 2-day systems audit which covers all sections of the laboratory. An audit report is issued within 2 weeks of completion. The LQAC has the responsibility for coordinating all responses to the audit finding and for following up on the required corrective action. A follow-up audit is made when deemed necessary by the District QA Manager.

The second phase consists of quarterly audits performed by the LQAC. These are day-long audits, and are concentrated on specific areas that are deemed problem areas by the LQAC. An audit report is issued at the

completion of the audit. Responses and follow-up corrective action to the audit findings are required, and are monitored by the LQAC.

All audit reports are issued to management and circulated to all staff. Copies are filed with the District Quality Assurance Manager and the LQAC.

12.2.3 Other Internal Audits

Barr through its QA Officer will be responsible for conducting internal performance and system audits of its subcontracting laboratories. Audits will be completed at a frequency of once per year.

Internal audits of the laboratory will assess the compliance with the laboratory portions of the QAPP; the RCRA Laboratory Audit Inspection Form from the "RCRA Laboratory Audit Inspection Guidance Document, September 1988" and the current revisions of the Organic and Inorganic Statements of Work for the CLP will guide the internal audit.

The on-site inspection will cover:

A. Qualifications of the laboratory personnel and the organizational structure of the laboratory

B. Procedures for maintaining laboratory supplies and equipment

C. Procedures for equipment calibration

D. Procedures for sample handling

E. Quality Control procedures

G. Procedures for data handling, reporting, record keeping

The on-site visit will also serve as a mechanism for discussing weaknesses identified through review of data deliverables. Lastly, the on-site visit will allow Barr to determine if the laboratory has implemented the recommended and/or required corrective actions, with respect to quality assurance, made during any previous on-site visits.

An internal laboratory audit report will be prepared by the Barr QA Officer. The audit report and any checklists or worksheets will be kept on file with the Barr QA Officer.

SECTION 13

PREVENTIVE MAINTENANCE

13.1 LABORATORY INSTRUMENTS

The laboratory is equipped with advanced instrumentation for fast, accurate, and precise analyses of water, soil/sediment, and air samples.

3.1.2 Maintenance Schedule

Preventive maintenance, such as lubrication, source cleaning, and detector cleaning, is performed according to the procedures delineated in the manufacturer's instrument manuals.

The frequency of preventive maintenance varies with different instruments. Routine maintenance performed includes cleaning and/or replacement of various instrument components. In general, the frequency recommended by the manufacturer is followed. In addition to the regular schedule maintenance is performed as needed. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance is performed when an instrument begins to degrade as evidenced by the degradation of peak resolution shift in calibration curves, decreased ion sensitivity, or failure to meet one or another of the quality control criteria.

Instrument maintenance log books are maintained in the laboratory at all times. The log book contains a complete history of past maintenance, both routine and nonroutine. The nature of work performed, the date, and the signature of the person who performed the work are recorded in the log book. Preventive maintenance is scheduled according to each manufacturer's

recommendation. Instrument down time is minimized by keeping adequate supplies of all expendable items on hand. Expendable items are those with an expected lifetime of less than one year.

Routine instrument preventive maintenance is handled by the instrument operator. Repair maintenance is performed by a full-time electronics technician, or by the manufacturer's service personnel.

SECTION 14

SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS

Precision, accuracy, and completeness are defined in Section 5 of the QAPP. Equations for calculating precision, accuracy, and completeness are detailed below.

Precision is a measure of the reproducibility of field sampling and laboratory analyses. Both field duplicates (replicates) and laboratory duplicates are analyzed to determine data precision. The results are reported as the relative percent difference (RPD) and are calculated by:

$$RPD = \frac{D1 - D2}{(D1 + D2)/2} \times 100$$

where:

D1 = concentration of first duplicate
D2 = concentration of second duplicate

The accuracy of analytical results is a measure of the agreement between an experimental determination of the true value of the parameter being measured. Spike's sample analyses are used to determine the accuracy of analyses. A known quantity of the constituent of interest is added to a sample and analyzed. The amount of spiked compound recovered by analysis is compared to the amount added. Percent recovery is calculated by:

$$\%R = \frac{SSR-SR}{SA} \times 100$$

SSR = quantity measured in spike sample

SR = quantity measured in unspiked sample

SA = quantity of spike added

The completeness of data from a sampling program is interpreted as the percentage of valid data obtained compared to the amount that was expected to be obtained.

$$\text{Completeness} = \frac{\text{Data values useable}}{\text{Total data values obtained}} \times 100$$

14.1 QUALITY CONTROL (QC) REVIEW

Data will be assessed by Barr Engineering Co. for the following QC elements:

- Sample Holding Times
- Accuracy of Spiked Samples
- Precision of Duplicate Samples
- Instrument Calibration
- Blank Results
- Surrogate Recovery
- Comparison with Historical Data
- Potential False Positive Results

A Quality Control Review Form Figure 3 will be completed for each laboratory report to summarize this data evaluation. An example of the Quality Control Review Form is provided in Appendix A.

All quality control reviews will be discussed with the project manager and the MPCA to determine the useability of the data.

SECTION 15.0

CORRECTIVE ACTION

Corrective action for this project is the responsibility of Barr Engineering Co., and MPCA. Corrective action will be implemented if it is determined that the data generated will not fulfill the project objectives.

When the QC data exceed the acceptance criteria, corrective actions will be implemented. Possible corrective actions might include:

1. Reanalysis of samples

2. Recollection and analysis of samples

Laboratory corrective actions are discussed in the laboratory QA Manual.

SECTION 16.0

QUALITY ASSURANCE REPORT TO MANAGEMENT

The quality assurance performance will be addressed in the final report to client. Any noncompliance with the QAPP or project concerns will be immediately reported to the project manager.

The performance of the laboratory as assessed by the quality monitoring systems in place is reported by the LQAC to management quarterly and as needed. Most, if not all reports are circulated to the staff to keep them informed of the laboratory's performance. Copies of all quality reports are maintained in the District Quality Assurance Manager and LQAC files.

Quality assurance reports to management include, but are not limited to, the following:

- Results of performance and systems audits
- Status of corrective actions
- Periodic assessment of data accuracy, precision, and completeness.

Tables

TABLE 1

TARGET COMPOUNDS AND QUANTITATION LIMITS

(μg/Kg)

Parameter	Quantitation Limit
Naphthalene	50
2-Methylnaphthalene	50
1-Methylnaphthalene	50
Acenaphthylene	50
Fluorene	50
Phenanthrene	50
Anthracene	50
Fluoranthene	50
Pyrene	50
Benzo(a)anthracene	50
Chrysene	50
Benzo(b)fluoranthene	50
Benzo(k)fluoranthene	50
Benzo(a)pyrene	50
Indeno(1,2,3-cd)pyrene	50
Dibenzo(a,h)anthracene	50
Benzo(g,h,i)perylene	50
Benzene	50
Ethylbenzene	50
Toluene	50
Xylene	50

The above quantitation limits do not account for any dilutions which may be required during sample analysis.

Figures

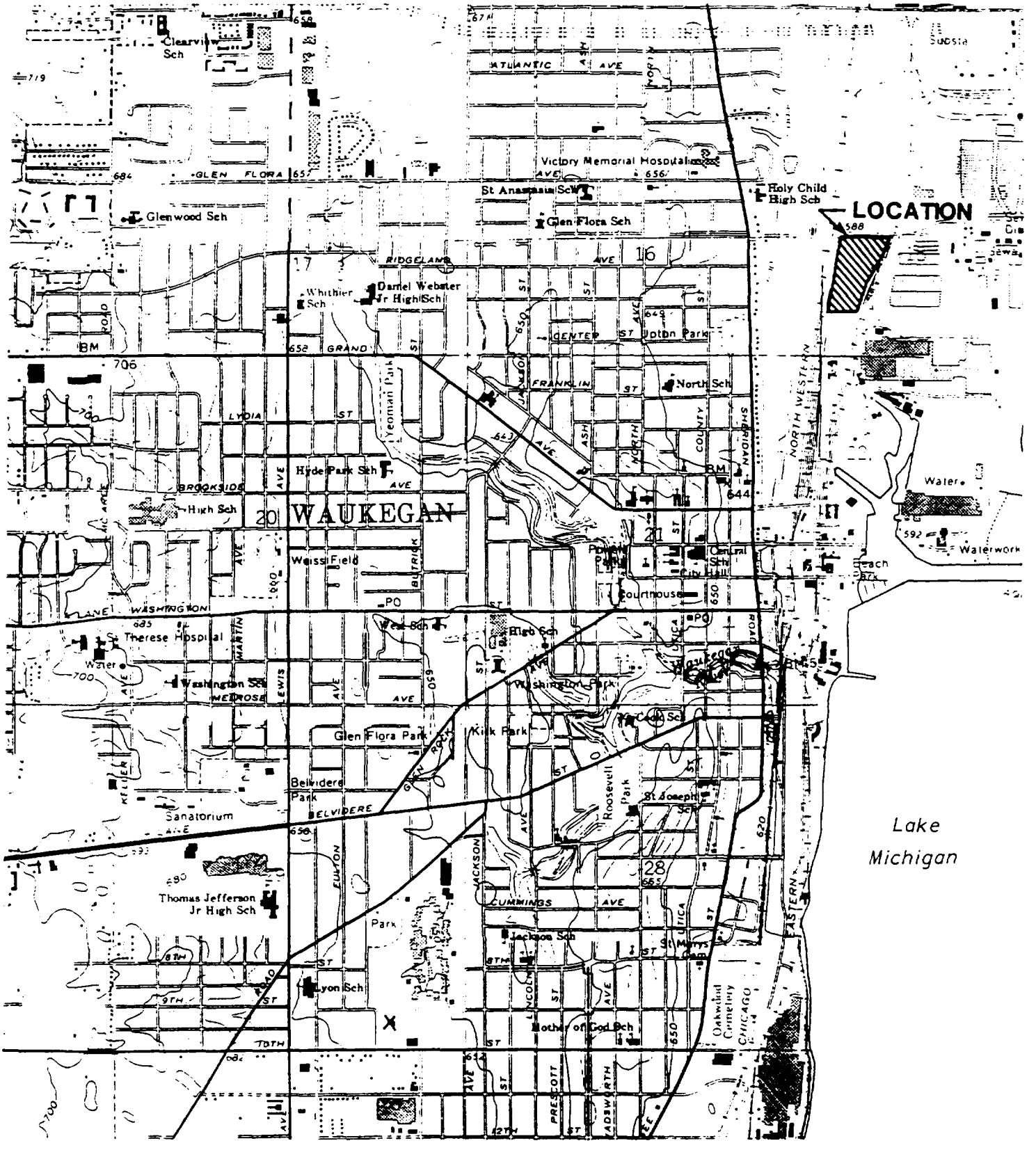
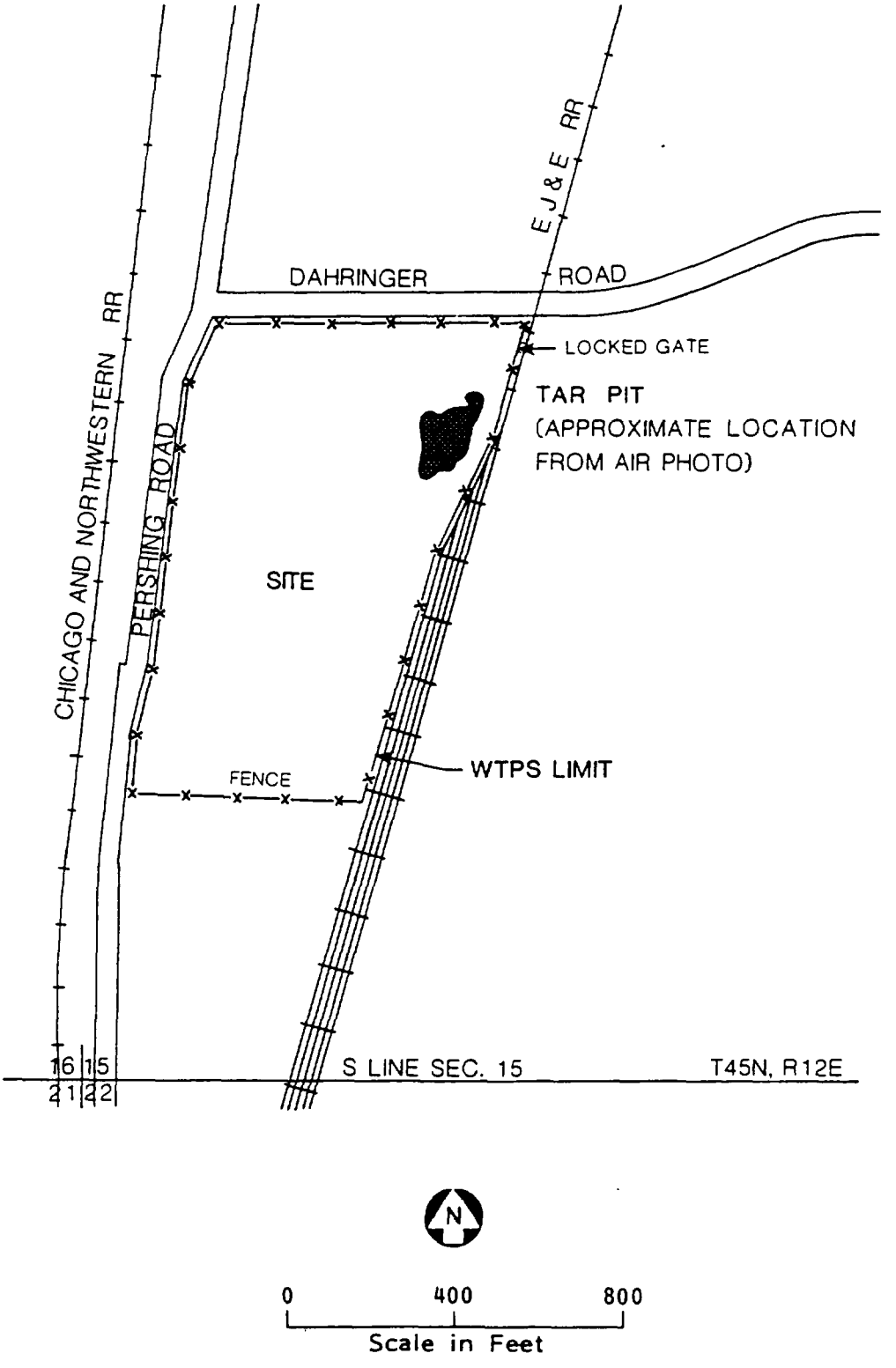


Figure 1

Waukegan Tar Pit Site
LOCATION MAP



—x—x— Chain Link Fence
(Approximate Location)

Figure 2

Waukegan Tar Pit Site
MAP OF IMMEDIATE VICINITY AND TAR PIT

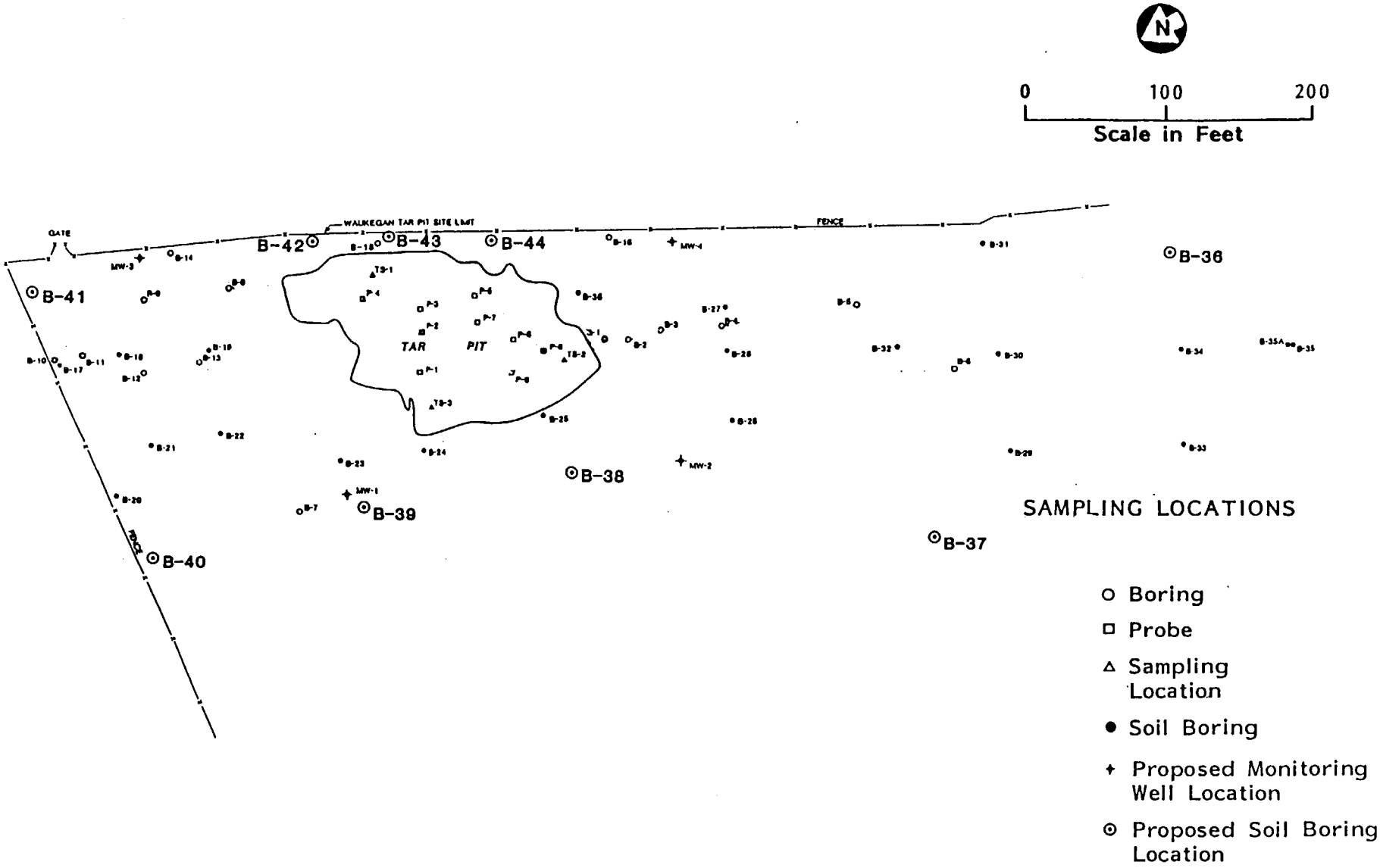
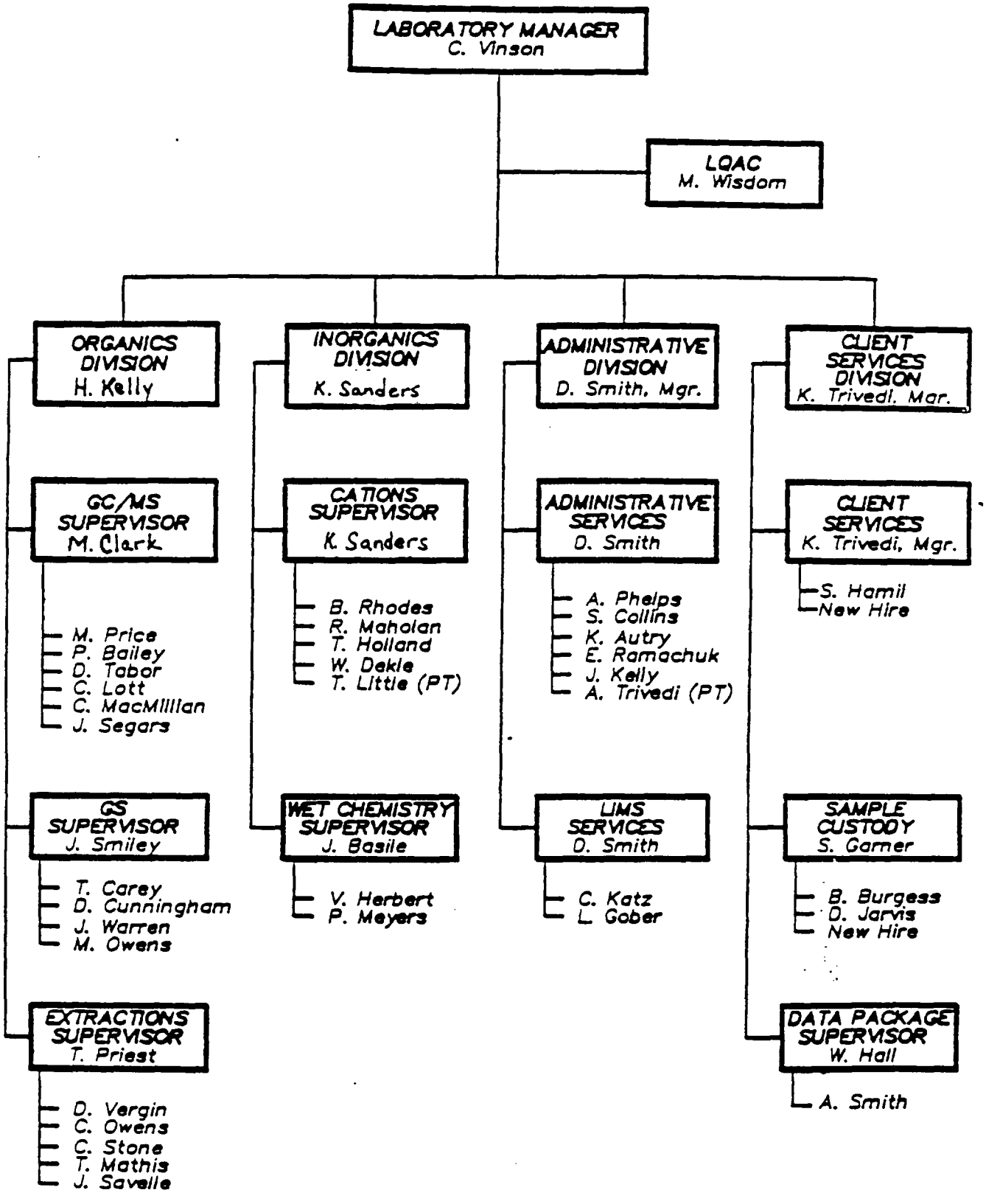


Figure 3

SAMPLING MAP



mgmR4/021.51

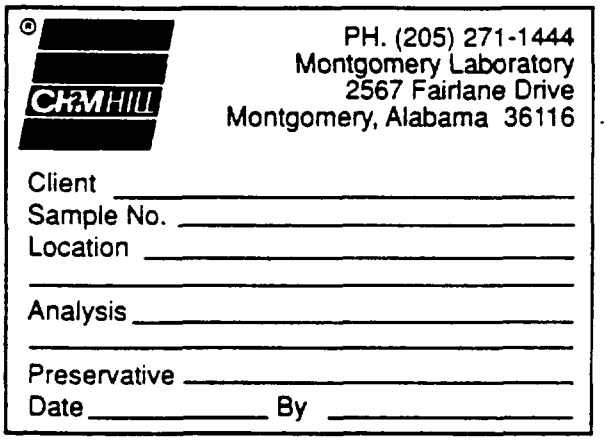
FIGURE 4

MONTGOMERY LABORATORY ORGANIZATIONAL CHART
APRIL 1990

CH2MHILL

50.DWG

FIGURE 5


CH2MHILL
PH. (205) 271-1444
Montgomery Laboratory
2567 Fairlane Drive
Montgomery, Alabama 36116
Client
Sample No.
Location
Analysis
Preservative
Date
By

IAIN OF CUSTODY

ARR ENGINEERING CO.
03 GLENROY ROAD
INNEAPOLIS, MN. 55435

ROJECT NUMBER

O: № 020442

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	GRAB	COMP.	BLANK	CONTAINER TYPE AND NUMBER: VOLATILE ORGANIC	PAH/PHENOLS	FILTERED METALS	UNFILTERED METALS	MERCURY	COD	GENERAL	CYANIDE	NUTRIENTS	REMARKS/ ANALYSIS REQUIRED

PROJECT MANAGER:

PROJECT CONTACT:

LABORATORY:

REMARKS/ ANALYSIS REQUIRED:

AMPLED BY:

ECEIVED BY:

ECEIVED BY:

EMARKS

RELINQUISHED BY:	DATE	TIME	RECEIVED BY LAB:	DATE	TIME
RELINQUISHED BY:	DATE	TIME	RECEIVED BY LAB:	DATE	TIME
RELINQUISHED BY:	DATE	TIME	RECEIVED BY LAB:	DATE	TIME

SAMPLES SHIPPED VIA
☐ AIR FREIGHT ☐ FED. EXP. ☐ SAMPLER
☐ OTHER

AIR BILL NUMBER:

TRIBUTION: WHITE-ORIGINAL ACCOMPANIES SHIPMENT TO LAB, RETURNS TO BARR WITH RESULTS; YELLOW-LAB COPY; PINK-LAB COORDINATOR; GOLD-FILED COPY

FIGURE 6